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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
ARTMAN, THOMAS R	

ART UNIT	PAPER NUMBER
2882	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/538,525	HARDING, GEOFFREY	
	Examiner	Art Unit	
	Thomas R. Artman	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 October 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-7,9,10,12-15,17,18 and 20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-7,9,10,12-15,17,18 and 20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 June 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 3-7 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Dependent claim 3, as incorporating the subject matter of its parent claim 1, encompasses new matter, as of the amendment dated June 20th, 2007, which was subsequently entered upon the filing of the Request for Continued Examination dated July 24th, 2007. This is due to the fact that the limitation, "said base arrangement comprises a rotatable base plate" was added to independent claim 1 from original dependent claim 2, which is now canceled.

Specifically, dependent claim 3 now encompasses an x-ray source that has a cooling circuit in the base arrangement, which is also defined in parent claim 1 to be rotatable. This combination of features has not been sufficiently described in the specification nor originally claimed. For example, Fig.5 is the only drawing that shows a rotatable base plate 12, and it can be seen from the drawing that the rotatable base plate does not have a cooling circuit. Furthermore, in Applicants' specification, p.8, line 31 through p.9, line 4, it appears that the rotatable base plate is not intended to have a cooling circuit. Particularly in lines 32-33 of p.8,

the specification states that the thermal calculations are the same, except for the fact that "the thermophysical parameters of the coolant are replaced by those of the anode base material." Page 9 continues by discussing other thermal concerns that are not related to coolant circuits.

Therefore, the invention as is now claimed in claim 3 contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors had possession of the claimed invention.

Claims 4-7 are rejected under this section by virtue of their dependency upon claim 3.

This is a new matter rejection.

Claims 3-7 are further rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Dependent claim 3, as incorporating the subject matter of its parent claim 1, contains subject matter for which the specification is not enabling, as of the amendment dated June 20th, 2007, which was subsequently entered upon the filing of the Request for Continued Examination dated July 24th, 2007. This is due to the fact that the limitation, "said base arrangement comprises a rotatable base plate" was added to independent claim 1 from original dependent claim 2, which is now canceled.

Specifically, dependent claim 3 now encompasses the subject matter of an x-ray source that has a cooling circuit in the base arrangement, which is also defined in parent claim 1 to be rotatable. This combination of features has not been sufficiently described in the specification to

enable one skilled in the art to make and/or use the invention. For example, Fig.5 is the only drawing that shows a rotatable base plate 12, and it can be seen from the drawing that the rotatable base plate does not have a cooling circuit. Furthermore, in Applicants' specification, there is no guidance for making the presently-claimed combination of features. In p.8, line 31 through p.9, line 4, the specification states that the thermal calculations are the same, except for the fact that "the thermophysical parameters of the coolant are replaced by those of the anode base material," and continues to discuss other thermal concerns that are not related to cooling circuits.

Therefore, the invention as is now claimed in claim 3 contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention.

Claims 4-7 are rejected under this section by virtue of their dependency upon claim 3.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 15, 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larson (US 5,602,899).

Regarding claims 15 and 17, Larson discloses an x-ray source (Fig.5), including:

a) an electron source 146 for emission of electrons in an electron beam 144,

b) a target 136 for emission of substantially monochromatic x-rays 147 in response to incidence of the electron beam onto the target, where

c) the target is comprised of a metal foil 136 having a thickness of a few microns and allowing the generation of high-intensity bremsstrahlung x-rays in a direction of transmission of the electron beam (inherent for such thin targets), and

d) generation of low intensity Bremsstrahlung x-rays 147 in a direction of reflection from the target, and further where

e) a base arrangement 132 includes a cooling circuit 138 to allow a coolant, water 140, to flow along the side of the metal foil 137 opposite to the side on which the electrons are incident, and further where

f) the target has a carrier 134 having a mean atomic number of less than 10 (diamond wafer) supporting the metal foil on the side facing the coolant, not allowing the generation of x-rays, where

g) a background of the low-intensity Bremsstrahlung x-rays, on which quasi-monochromatic characteristic lines of the metal foil are superimposed, results in a quasi-monochromatic spectrum of x-rays 147 produced on the side of the metal foil on which the electrons are incident and which is opposite to the side of the base arrangment (inherent fundamental quantum-physical result of e-beam impingement).

Further regarding claim 15, Larson does not specifically disclose that the thickness of the metal foil is between 1-3 microns. Larson specifically discloses a thickness of about 4 microns, where the target is made of materials such as aluminum and magnesium, under 10 to 20 kV e-beam energies (col.5, lines 22-23).

However, Larson teaches in col.1, lines 55-58, that the target layer should be as thin as possible, of only a few microns, for efficient cooling. Larson further teaches in col.5, lines 17-23, that the precise thickness of the target layer, within this range of "a few microns," is determined by penetration depth of the e-beam, which is itself a funcion of acceleration voltage and target material. Based upon these paramters, and based upon the need for x-ray generation efficiency and cooling efficiency, the target layer is taught to be approximately twice the penetration depth of the e-beam. The skilled artisan would readily recognize that a target material of tungsten (which is ubiquitous in the medical imaging field and is often used at 10 or 20 kV for mammography and dental imaging) would be able to be significantly thinner than 4 microns because the penetration depth for a given e-beam energy is much less than that of aluminum and magnesium.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Larson to have a target layer between 1 and 3 microns thick, based upon a desired target material and an intended e-beam energy range, in order to maximize cooling efficiency and x-ray generation efficiency, as taught by Larson.

With respect to claim 18, Larson further discloses that the cooling circuit has a constriction proximate the metal foil (Figs.4 and 5).

Claims 1, 3-7, 9, 10, 12-14 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larson in view of Yoshihara (US 4,238,706).

Regarding claims 1, 7, 10, 12, 14 and 20, Larson discloses an x-ray source (Fig.5), including:

a) an electron source 146 for emission of electrons in an electron beam 144,

b) a target 136 for emission of substantially monochromatic x-rays 147 in response to incidence of the electron beam onto the target, where

c) the target is comprised of a metal foil 136 having a thickness of a few microns and allowing the generation of high-intensity bremsstrahlung x-rays in a direction of transmission of the electron beam (inherent for such thin targets), and

d) generation of low intensity Bremsstrahlung x-rays 147 in a direction of reflection from the target, and further where

e) a base arrangement 132 includes a cooling circuit 138 to allow a coolant, water 140, to flow along the side of the metal foil 137 opposite to the side on which the electrons are incident, and further where

f) the target has a carrier 134 having a mean atomic number of less than 10 (diamond wafer) supporting the metal foil on the side facing the coolant, not allowing the generation of x-rays, where

g) a background of the low-intensity Bremsstrahlung x-rays, on which quasi-monochromatic characteristic lines of the metal foil are superimposed, results in a quasi-monochromatic spectrum of x-rays 147 produced on the side of the metal foil on which the

electrons are incident and which is opposite to the side of the base arrangment (inherent fundamental quantum-physical result of e-beam impingement).

Further regarding claims 1, 10, 12 and 20, Larson further discloses that:

h) an outcoupling means (not shown) which generally only transmits x-rays 147 propagating in the reflection direction of the metal foil over an angular range of +/- 20 degrees antiparallel to the incident direction of the e-beam (Fig.5), where

i) the e-beam is directed onto the surface of the metal foil at a substantially 90 degree angle (Fig.5),

j) the x-rays are outcoupled at angles of an angular range from substantially 70 to 110 degrees from the surface of the metal foil (Fig.5), and

k) the x-rays are outcoupled at an angle in the range of 160 to 180 degrees to the direction of incidence of the e-beam (Fig.5).

Further regarding claims 1 and 14, Larson does not specifically disclose that the thickness of the metal foil is between 1-3 microns. Larson specifically discloses a thickness of about 4 microns, where the target is made of materials such as aluminum and magnesium, under 10 to 20 kV e-beam energies (col.5, lines 22-23).

However, Larson teaches in col.1, lines 55-58, that the target layer should be as thin as possible, of only a few microns, for efficient cooling. Larson further teaches in col.5, lines 17-23, that the precise thickness of the target layer, within this range of "a few microns," is determined by penetration depth of the e-beam, which is itself a funcion of acceleration voltage

and target material. Based upon these paramters, and based upon the need for x-ray generation efficiency and cooling efficiency, the target layer is taught to be approximately twice the penetration depth of the e-beam. The skilled artisan would readily recognize that a target material of tungsten (which is ubiquitous in the medical imaging field and is often used at 10 or 20 kV for mammography and dental imaging) would be able to be significantly thinner than 4 microns because the penetration depth for a given e-beam energy is much less than that of aluminum and magnesium.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Larson to have a target layer between 1 and 3 microns thick, based upon a desired target material and an intended e-beam energy range, in order to maximize cooling efficiency and x-ray generation efficiency, as taught by Larson.

Further regarding claims 1 and 14, Larson does not specifically disclose that the base arrangement includes a rotatable base plate. The base plate 134 of Larson is not rotatable.

However, Larson does teach that the base plate needs to be moved in order to keep a fresh surface upon which the e-beam impinges to reliably generate x-rays (col.5, lines 26-30).

Yoshihara teaches a rotating base plate 31 (Fig.3B) for a metal foil impinged upon by an e-beam to generate x-rays. The base plate of Yoshihara is of similar construction to that of Larson. It is further an established practice to rotate an x-ray target as an efficient method of providing a fresh surface for reliable x-ray generation.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Larson to have a rotatable base plate, as taught by Yoshihara, in order to provide a fresh surface for the reliable generation of x-rays, as taught by Larson.

With respect to claims 3-5, both Larson and Yoshihara disclose base arrangements having cooling circuits arranged to allow a coolant, water, to flow along the side of the metal foil opposite to the side on which the electrons are incident (Fig.5 of Larson; Fig.3B of Yoshihara).

With respect to claim 6, both Larson and Yoshihara disclose a constriction of the cooling circuit in the area of the metal foil (Fig.5 of Larson; Fig.3B of Yoshihara).

With respect to claim 9, neither Larson nor Yoshihara specifically disclose that the metal foil has an atomic number between 40 and 80.

However, the skilled artisan is readily aware of the fact that such materials, including Molybdenum, Tantalum, and particularly Tungsten, are all quite common for x-ray target materials and are all able to be made into thin foils and withstand the high temperatures, high mechanical stresses and vacuum environments of x-ray tubes. The use of a particular target material depends primarily upon the desired energy spectrum of the resultant x-rays.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Larson to use a metal foil having an atomic number in the range of 40 to 80 depending upon the desired x-ray energy output, as it known in the art.

With respect to claim 13, Larson further discloses that the electron source 146 is located outside the x-ray beam 147 to be outcoupled, where the x-ray source additionally has means to direct the e-beam 144 onto the metal foil (not shown, inherent due to curved path of e-beam 144, Fig.5).

Response to Arguments

Applicant's arguments with respect to claims 1, 14 and 15 have been considered but are moot in view of the new grounds of rejection. The present amendment has overcome the prior rejections of record.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas R. Artman whose telephone number is (571) 272-2485. The examiner can normally be reached on 9am - 5:30pm Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Thomas R. Artman
Patent Examiner